

very important, but have not hitherto received much attention. A chemical transformation is impossible, if its occurrence would involve the opposite of dissipation (for which there is no convenient word); but it is not true, on the other hand, that a transformation which would involve dissipation must necessarily take place. Otherwise, the existence of explosives like gunpowder would be impossible. It is often stated that the development of heat is the criterion of the possibility of a proposed transformation, though exceptions to this rule are extremely well known. It is sufficient to mention the solution of a salt in water. This operation involves dissipation, or it would not occur, and it is not difficult to see how work might have been obtained in the process. The water may be placed under a piston in a cylinder maintained at a rigorously constant temperature, and the piston slowly raised until all the water is evaporated, and its tension reduced to the point at which the salt would begin to absorb it at the temperature in question. After the salt and vapour are in contact, the piston is made to descend until the solution is effected. In this process work is gained, since the pressure under the piston during the expansion is greater than at the corresponding stage of the contraction. If the salt is dissolved in the ordinary way energy is dissipated, an opportunity of doing work at the expense of low temperature heat has been missed and will not return.

The difficulty in applying thermodynamical principles to chemistry arises from the fact that chemical transformations cannot generally be supposed to take place in a reversible manner, even although unlimited time be allowed. Some progress has, however, recently been made, and the experiments of Debray on the influence of pressure on the evolution of carbonic anhydride from chalk throw considerable light on the matter. By properly accommodating the pressure and temperature, the constituents of chalk may be separated or recomposed without dissipation, or rather dissipation may theoretically be reduced without limit by making the operation slowly enough.

The possibility of chemical action must often depend on the density of the reacting substances. A mixture of oxygen and hydrogen in the proper proportions may be exploded by an electric spark at the atmospheric pressure, and energy will be dissipated. In this operation the spark itself need not be considered, as a given spark is capable of exploding any quantity of gas. Suppose, now, that previously to explosion the gas is expanded at constant temperature, and then after explosion brought back to the former volume. Since in the combination there is a condensation to two-thirds, the pressure required to compress the aqueous vapour is less than that exercised at the same volume by the uncombined gases, and accordingly work is gained on the whole. Hence the explosion in the expanded state involves less dissipation than in the condensed state, and the amount of the difference may be increased without limit by carrying the expansion far enough. It follows that beyond a certain point of rarity the explosion cannot be made, as it could not then involve any dissipation. But although the tendency to combine diminishes as the gas becomes rarer, the heat developed during the combination remains approximately constant.

It must be remembered that the heat of combination is generally developed at a high temperature, and that therefore work may be done during the cooling of the products of combustion. If, therefore, it is a necessity of the case that the act of combustion should take place at a high temperature, the possibility of explosion will cease at an earlier point of rarefaction than would otherwise have been the case.

It may probably be found that many mixtures which show no tendency to explode under ordinary conditions will become explosive when sufficiently condensed,

## NOTES

THE *Bonner Zeitung* publishes [a letter of Dr. Seeliger, containing the first detailed reports from the German party of observers sent to the Auckland Islands to observe the Transit of Venus. Dr. Seeliger speaks of the weather in these islands as the most wretched imaginable; enough, he says, to drive an astronomer to despair. "Clear evenings are very rare, and sunshine a phenomenon." On Dec. 9, at 12.45 P.M., "Venus was to appear on the sun's disc; one minute passes after another, and still all is covered. At last the clouds thin a little, and without dark glass we can easily see Venus, that had just entered on the sun's disc. The two first contacts, which, however, were of less value to us, were lost therefore. A quarter of an hour afterwards a little gap shows itself in the clouds, the sun breaks through, and we at once set to work, so as not to lose a single moment. And now comes the wonder! For nearly four hours the sun remains completely free from clouds. In the east and in the west thick clouds; only where the sun stands it is clear. Hardly has Venus passed off the sun's disc, therefore hardly have we completely succeeded with our measurements, when the sky is again overcast all over. To-day the day is dull, as usual. As affairs stand we shall very likely have to stop here two or two-and-a-half months longer, because we have not yet been able to do anything for the other astronomical data, which are indispensable. On the one hand it is hardly possible to do anything in this climate at this time, and then we finished our general preparations only a long time after we thought we should do so."

WE regret to record the death of Carl Ludwig Christian Becker, who has for so long been known to students of physical science in this country in connection with the firm of Elliott Brothers. He was born at Ratzeburg, in the Grand Duchy of Mecklenburg Strelitz, July 16, 1821, and received his general education at the Gymnasium of his birthplace, of which his father was Rector. He studied his profession with Repsold at Hamburg, Kraft at Vienna, and Steinheil at Munich, and came to London in 1849, joining the firm of Elliott Brothers in 1858. Within the last few years he became a member of the Society of Telegraph Engineers and Fellow of the Royal Astronomical and Physical Societies. We believe that there is no one who has pursued physical inquiries in England who will not look upon his loss as that of a personal friend, while his skill in providing new appliances for investigation reminds us how often the most important scientific work is dependent upon the skilled mechanic.

THE Royal Academy of Medicine at Brussels has given its opinion on the so-called "miracle," Louise Lateau, who, it is said, by divine assistance abstains from taking food, and has done so for years together. Moreover, this miraculous creature has some wounds in her hands, side, and feet, which are said to be true representations of those of Christ, and which bleed profusely every Friday. Dr. Virchow, the celebrated German anatomist, has made her the subject of a little pamphlet, "Ueber Wunder." The opinion of the Brussels Academy, which is quite in accordance with that of Dr. Virchow, is as follows:—"Louise Lateau works and requires heat; every Friday she loses a certain quantity of blood by her wounds. When she breathes, she exhales water vapour and carbonic acid; her weight has not decreased since she has been observed; she therefore consumes carbon which is not furnished by her system. Where does she take this carbon from? Physiology simply replies, 'She eats.' The alleged abstinence from all food of Louise Lateau is contradictory to all physiological laws; it is therefore hardly necessary to prove that this abstinence is an invention. Whoever alleges that Louise Lateau is not subject to physiological laws, must prove it; until this is done physiology will denote the miracle to be a deception. Could Louise Lateau be

closely observed night and day by scientific men, the deception would soon come to light. It is of no use to talk of miracles, even when eleven doors are shut against deceit, as long as the twelfth is left open."

THE International Congress on Silk-culture is to hold its fifth meeting at Milan during 1876. The Committee has sent a programme of experiments to be made during 1875 to all silkculturists of Europe. This programme treats of the most important questions connected with the keeping of silkworms, the prevention of their diseases, particularly of their "inactivity;" the latter is a disease which has done great damage of late years. M. Pasteur has proposed as a remedy to isolate the deposits of ova into separate cells; but this has proved totally ineffective. However, with investigators like Cornalia, Duclaux, Bolle, and others, on this field, it may safely be expected that means and ways will soon be found to prevent any serious diseases from raging among silkworms and their ova.

SWEDISH newspapers report the discovery of a large deposit of hematite iron ore in the district of Nordland, Norway, some fifteen or twenty miles from Bodö, and only about ten or twelve miles from a Norwegian port which is completely free from ice. The analysis of the ore shows that it contains between fifty-four and sixty-seven per cent. of iron, and only a very small percentage of phosphates.

PROF. Haeckel, of Jena, has been lecturing at the Karlsruhe Museum on the coral reefs of the Red Sea. Prof. Michelis has asked him in the *Karlsruher Zeitung* whether he will give him the opportunity of a public discussion. It is said that Dr. Michelis will soon publish a purely scientific refutation of "the German Darwin's" *Anthropogeny*.

*Dingler's Polytech. Journal* contains an account of researches made by Dr. Otto Krause, of Annaberg, on tobacco smoke, which he finds contains constantly a considerable quantity of carbonic oxide. The after effects of smoking are said to be principally caused by this poisonous gas, as the smoker never can prevent a part of the smoke from descending to the lungs, and thus the poisoning is unavoidable. The author is of opinion that the after effects are all the more energetic, the more inexperienced the smoker is, and he thus explains the unpleasant results of the first attempts at smoking, which are generally ascribed to nicotine alone.

A MALADY which threatens great loss to owners of lemon plantations has attacked the lemon plant, the origin of which is believed to be the forced cultivation of the fruit, which has taken place during the last few years. The lemon plant is very hardy, and infinitely easier to cultivate than the orange, and this fact has probably induced a certain amount of carelessness in its treatment, from which growers are now suffering. The tree was originally a native of the dry and hot soil of Persia, whence it has been transferred to various other countries, where, under different circumstances of soil and climate, it has been made largely to increase its yield of fruit. The disease which has now made its appearance is called *la sécheresse*, or dry rot, and seizes the extremities of the plant, sometimes the roots, sometimes the branches, whence it gradually spreads through the whole tree, drying up its sap in its course. Hitherto attempts have been made to check the ravages of the new disease, but without success. It is said that similar appearances have been noticed in orange plantations. It is suggested that by grafting cuttings of the healthy lemon plant on the wild orange tree, a new stock of plants may be obtained, and the fruit cultivated on trees which have not been subjected to forced growth. If this plan succeeds, it is to be hoped that the cultivation of the new race may be carried on with greater care in the future.

VICE-CONSUL ALLEN, in his report of the trade of Tamsuy and Kelung, describes the distillation of the camphor of commerce from *Cinnamomum camphora*, Fr., Nees et Eb., as a most hazardous trade, the distillers having to be constantly on the alert for fear of attack by the aborigines, who are naturally opposed to the continual encroachments into their territory for the purpose of cutting down the trees for extracting the camphor. No young trees are planted to replace those cut down, nor do the officials take any cognisance of the diminution which is being surely effected in the supply of a valuable commercial article. The stills are described as being of a very simple construction, and are built up in a shed in such a manner that they can be moved as the Chinese advance into the interior. A long wooden trough, coated with clay and half filled with water, is placed over eight or ten furnaces; on the trough boards pierced with holes are fitted, and on these boards are placed jars containing the camphor-wood chips, the whole being surmounted by inverted earthenware pots, and the joints made air-tight by filling them up with hemp. When the furnaces are lit the steam passes through the pierced boards, and saturating the chips, causes the sublimated camphor to settle in crystals on the inside of the pots, from which it is scraped off and afterwards refined. During the summer months the camphor often loses as much as 20 per cent. on its way from the producing districts to the port of shipment.

MR. BARNUM is said to have made an agreement with Mr. Donaldson, the aeronaut of the U.S. *Daily Graphic*, to build six balloons of 70,000 cubic feet each, and to make ascents next spring and summer, in order to ascertain whether there is a current from America to Europe. The sum paid to Donaldson as fees is said by the *New York World* to be 4,000*l*.

THE Clothworkers' Company have founded in King's College, London, one annual exhibition of 25*l*. for two years for proficiency in science, open not only to actual students of the College, but to all under nineteen years of age who are intending to devote themselves to the study of mathematics, mechanics, physics, chemistry, botany, and zoology. Each candidate may select any four of these subjects.

DR. EDOUARD HITZIG, of Berlin, who is well known for his researches on the functions of the brain, has been elected to the chair of Psychology in the University of Zürich.

PROF. ARMSTRONG, of the London Institution, and Mr. E. J. Mills, D.Sc., Assistant Examiner in Chemistry in the University of London, are candidates for the vacant Jacksonian Professorship of Natural and Experimental Philosophy in Cambridge University. The other candidates are Mr. W. N. Hartley, Mr. James Stuart, and the Rev. J. C. W. Ellis.

MR. A. H. GARROD, of King's College, Cambridge, has been appointed Fullerian Professor of Physiology to the Royal Institution for the next three years.

A TELEGRAM has been received by the Berlin African Society from Lisbon announcing that Herr Homeyer, the African traveller, had safely reached Loanda, whence he proposed starting for the interior on the 11th of February. Herr Homeyer had been everywhere very well received.

THE Scottish Meteorological Society, through its president, the Marquis of Tweeddale, has addressed to Sir Stafford Northcote a letter urging the claims of that Society on Government for support. As our readers are aware, this is not the first time this Society has urged its claims for assistance on Government; it is advantageously situated, and has done very much both for the advancement of the science of meteorology and for the practical application of its results in directions beneficial to the country at large. It assuredly deserves the countenance of the Government,



were it for nothing else than the practical results of its labours, and we have no doubt that the statements forwarded to the Chancellor of the Exchequer will be seriously considered, with the result that the prayer of the Society will be granted.

WE take the following from the *Times*:—The vote proposed this session for Aid to the Science Commission is but 597. It is fully expected that the labours of the Commission will be completed by the end of December; but there is much work yet in hand. Five reports have been published, and five more are in preparation, on—1, Science Teaching in Public and Endowed Schools; 2, the University of London; 3, the Scotch Universities; 4, the Irish Universities; 5, the Advancement of Science. Reports on science teaching in public and first-grade schools in England and on the aid given by the State to science in France have been prepared by the secretary. It is proposed that three of the Commissioners should visit the various colleges in Germany to make inquiry with regard to scientific instruction and the advancement of science in that country.

FROM the Annual Report of the Geologists' Association, we learn that that Society is in a prosperous condition. The increase to its numbers during last year was thirty-one, and the total number of members of all classes was, on Jan. 1st, 339.

THE *soirée* of the Paris Observatory, which took place on the 1st of April, was a very brilliant one. The saloons were crowded with provincial *savants* and their families. The great glass of the new reflector had been arranged on its edge in the Meridian Hall, so that visitors might admire the perfection of its polish. The company retired at a late hour, and on the following morning, we regret to say, M. Leon Leverrier, the eldest son of the illustrious astronomer, was found dead in his bed. He was thirty-seven years of age, a pupil of the Polytechnic School, and the consulting chemist of the Western Railway.

THE competition for prizes in connection with the University of Aberdeen, to which we alluded in our number for March 25 (p. 413), is, we are informed, confined to those who were matriculated students of the University during Session 1874-75.

THE African explorer, Dr. Mauch, who fell from a window at Blaubeuren on the 27th ult., died on the 4th inst.

WE have received from Dr. H. Hildebrand Hildebrandsson, of Upsal, a valuable paper just published on the upper currents of the atmosphere. Systematic observations of the movements of the cirrus cloud were set on foot at most of the Meteorological Stations in Sweden in December 1873. This paper, which is an able discussion of these observations, is an important contribution to the vital question of the circulation of the atmosphere; we shall give a detailed notice of it in an early number.

AN international conference for telegraphy will be held at St. Petersburg on the 1st of June. Twenty-four nations and twenty submarine companies are said to have agreed to send delegates to deliberate on a new telegraphic convention.

By the will of the late Mr. James Young, of Bournemouth, the testator leaves, amongst other legacies, the sum of 100*l.* to John Stenhouse, M.D., F.R.S., to show his appreciation of his services to mankind by the great discovery of charcoal as an air-filterer.

PART 3 of *Petermann's Mittheilungen* contains the beginning of a report on Livingstone's travels in Central Africa, from 1866 to 1873, with extracts from his journals, and a large map drawn by Petermann after the English edition of Livingstone's journals. Even the most recent discoveries are entered on the map; for instance, the outlet of the Tanganyika Lake, discovered by Cameron, by which this lake is in direct communication with the source-district of the Congo, which Livingstone visited,

without being able, however, to discern all its relations and connections. It is very doubtful whether in England a map can already be found, which is in the least to be compared to that of Petermann.

THE *conversazione* of the Royal Society, which we announced in a recent number, took place last evening; we hope to be able to give details next week.

SUPPLEMENT No. 40 of *Petermann's Mittheilungen* consists of a detailed description of the Alpine region lying between the valleys of the Rhine and the Inn, the author being A. Waltenbergen. It is accompanied by one large general and two smaller special maps.

THE meeting of the delegates of the French learned societies was inaugurated on the 31st March, and was held on the 1st and 2nd of April, at the Sorbonne. The concluding *séance* was occupied with the distribution of rewards, under the presidency of M. Wallon, the new Minister. M. Wallon gave a summary account of all the works which are carried on with the help of Government. He alluded to a recent law passed by the National Assembly, and which now regulates grants to travelling expeditions. A special commission has been established to appoint explorers and determine the amount of money required in each case in order to fulfil the ends of the journey. Each person sent out has to write an account of the work done, and the commission must report on the value of results thus obtained.

A NEW notation for thermometers has been invented by the present director of the Copenhagen Meteorological Board, and consists merely in taking the complement to 100° of each negative degree. Although it has been intended for the Celsius thermometer, it can be extended to Fahrenheit with much advantage in the rare cases in which negative degrees are used on that scale. Suppose the following series of temperatures has been obtained: +7 - 3 + 1 - 5 + 4 - 3 - 2 + 5, for the minimum of successive days in March, according to the new style it should run so: +7 + 97 + 1 + 95 + 4 + 97 + 98 + 5. The sum is 404 minus 400 = 4. Mean is equal to  $\frac{4}{8} = \frac{1}{2}$ . If possible, it is more difficult with Fahrenheit than with Celsius to commit any error, and means are taken with each scale with an equal facility.

FROM the Tenth Quarterly Report of the Sub-Wealden Exploration, we learn that the total depth of the new boring commenced February 11 is 373 feet. From the surface to the gypsum, say about 127 feet, the beds consist of alternating shales, limestones, and calcareous clays, all effervescing with acid; more or less fissured, varying in compactness and hardness from that of Purbeck kerbstone to that of Windsor soap. A considerable thickness, over 30 feet, of pale grey sand and sandstone immediately succeeds the gypsum, followed by calcareous shales, to the Kimmeridge clay at about 290 feet. This sand is supposed by the authorities to be the representative of the Portland series. It contains casts of annelides and the claws of one or two small species of crab. The report contains an account of the boring at Sperenberg, about twenty-three miles south of Berlin, which was prosecuted to a depth of 4,172 feet.

THE additions to the Zoological Society's Gardens during the past week include a Red-bellied Wallaby (*Halmaturus billardieri*) from Tasmania, a Vulpine Phalanger (*Phalangista vulpina*) from Australia, presented by Mr. Bolton Glanville Corney; a Lesser Sulphur-crested Cockatoo (*Cacatua sulphurea*) from Moluccas, presented by Mr. William Holborn; a Crowned Partridge (*Rollulus cristatus*) from Moluccas, presented by Mr. Barclay Field; an Indian Python (*Python molurus*) from India, presented by Mr. A. J. S. Terris; a Nisnas Monkey (*Cercopithecus pyrrhonotus*) from Nubia, deposited; a Wheatear (*Saxicola ananthe*) European, purchased.